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Financial Risk Management, Firm Structure & Valuation, An Empirical Analysis

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Résumé:

Ce rapport examine si les évidences empiriques sur la structure de l'entreprise, sa valeur marchande et la gestion des risques financiers soutiennent le modèle théorique proposé par Boyer, Boyer and Garcia (2005). La base de données est composée des firmes américaines du S&P500 pour l'année 2004, les données comptables et de marché sont extraites de 1993 à 2004, et celles pour l'utilisation des produits dérivés et les portefeuilles des dirigeants à partir des rapports annuels de 2004. Nos résultats mettent en évidence une relation empirique entre la valeur de la firme, son bêta et le taux sans risque. De plus, nous avons développé un estimateur pour la flexibilité des activitées de l'entreprise. Ce facteur de flexibilité semble être un nouveau déterminant empirique de la gestion des risques opérationnels. Finalement, concernant l'explication de l'utilisation des produits dérivés, nous observons que les déterminants changent en fonction du type de risque couvert.

Mots-Clés: Flexibilité, Gestion de Portefeuille de Projets, Gestion des Risques Financiers, Valeur de l'Entreprise

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Master Thesis

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Financial Risk Management, Firm Structure & Valuation, An Empirical Analysis

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Abstract:

This paper investigates if empirical evidence on the firm structure, its market value and its corporate hedging decisions support the theoretical model proposed by Boyer, Boyer and Garcia (2005). The database is composed by firms of the US S&P500 in 2004, market and accounting data are collected from 1993 to 2004, then hedging and managerial shareholding data are extracted from 2004 annual reports. Our results show empirical relations between the firm market value, its beta and the risk free rate. Moreover, we have created an estimator for the flexibility of the firm's activities. The Flexibility Factor is validated as a new empirical determinant of operational risk hedging decisions. Finally, for the explanation of the use of derivatives, we provide evidence that significant variables change according to the type of risk hedged.

Keywords: Flexibility, Financial Risk Management, Firm Value, Project Portfolio Management

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1 Introduction

Financial Risk Management is a new topic in the empirical finance literature thanks in part to the creation of new databases on hedging activities. Many questions have been raised and are still without satisfactory answers: What are the value and the motivations of using these tools (i.e. derivatives)? Is there a theoretical framework that could explain these activities?

There is a controversy in the finance industry about the value of hedging. Firms use derivatives in order to fix the price paid or/and received, this could be useful as a tool to predict cash flows expenses or/and income and for the firm to be able to produce less uncertain expected balance-sheet. Moreover, derivatives can be also used for speculation, for example on a specific commodity price, but this is an unofficial practice since risk management has normally no speculative purpose. For portfolio managers, a firm that hedges its activities seems less risky but hedging also erases exposition and so a speculative return. Hence, we observe a dual effect and it is not trivial to determine the effect of using derivatives on the firm market value.

The aim of this paper is to check empirically the implications that could be derived from the model proposed by Boyer, Boyer and Garcia (2005) (BBG) and to study a new determinant for the motivation of corporate hedging. The study of their theoretical framework lead us to analyse two empirical relations out of the financial risk management subject: the first one between the mix of activities chosen by the firm (i.e. the firm structure) and the risk premium; the second between the firm market value and the risk free rate dependent on the firm's beta level. The third and last empirical relation is the flexibility of the firm and the use of derivatives for hedging.

For the theoretical literature[4] review, we begin with the Modigliani and Miller (M&M) world where the firm value is determined by its activities and investment decisions and not by its financial structure. Therefore in this framework, financial risk management has no value. More recently, Smith and Stulz (1985) have relaxed the perfect market assumption made by M&M, finding that a firm which maximizes its value, hedges its activities for three reasons: taxes, financial distress cost and managers risk aversion. Thus, in this model, financial risk management has some value for these first two reasons.

In the empirical literature[5], many papers[6] are related to a specific industry (ex: natural gas) or to a specific risk (ex: currency risk and the use of currency swaps or other currency derivatives). We can cite two papers which relate empirical results including almost every industry (with the exception of the

[4] See the Appendix for a complete theoretical literature review of financial risk management motivations and valuation.

[5] See the Appendix for a review of determinants of corporate hedging activities studied in the empirical literature. We decompose the results in function of the dependant variable, which is either the level of hedging (for example the notionnal value of derivatives used) or the decision of hedging (binary variable, equals 1 if the firm uses derivatives).

[6] See for example: Allayannis, G. and Weston, J.P. (2001), Dionne, G. and Garand, M. (2003), Tufano, P. (1996), and Viswanathan, G. (1998).

financial industry because they are users and providers of derivatives). The first one from Mian (1996) underlines that the financial distress cost reason is not empirically validated, and the one for taxes is mitigated; however, he has found a significant size effect. The second, from Graham and Rogers (2002), found a new empirical reason why firms hedge: to increase debt capacity.

This paper is organized as follows: in section 2, BBG model and three majors theoretical relations are explained. In section 3, the empirical methodology and results are exposed. Finally, section 4 concludes.

2 Theoretical Model

2.1 BBG Model Presentation[7]

A firm is decomposed by realized and possible projects represented in a $E_i - SCOR_{im}$ framework. E_i are the expected cash flows from the project i. The second component is the scaled correlation of the project i: $SCOR_{im} = \rho_{im} \times \sigma_i$, where ρ_{im} is the correlation of the cash flows of the project i with the market return m and σ_i is the standard deviation of the project i's cash flows.

Given all the constraints faced by the firm such as technology or regulation, we can construct a frontier of possibilities for cash flows. The envelope of all feasible combinations is by construction concave. In our model, we assume there is a single risk factor: the market portfolio. Hence, a firm j is valued in terms of its expected cash flows discounted by an expected rate of return given by the CAPM:

$$ER_j = R_F + \beta_{jm} \times (E[R_M] - R_F)$$

with the risk free rate (R_F), the expected market return ($E[R_M]$) and its beta (β_{jm}).

For simplicity, we assume that cash flows are constant through time. So the value of the firm is $V_j = \frac{E_j}{ER_j}$ where E_j are the total expected cash flows of the firm for the next period. We can express the security market line in terms of cash flows:

$$E_j = V_j \times ER_j = V_j \times R_F + V_j \times \beta_{jm} \times (E[R_M] - R_F).$$

$V_j \times \beta_{jm}$ represents the risk of the firm's cash flows:

$$V_j \times \beta_{jm} = V_j \times \frac{Cov[R_j, R_m]}{\sigma^2[Rm]} = \frac{Cov[V_j \times R_j, R_m]}{\sigma^2[Rm]} = \frac{Cov[CF_j, R_m]}{\sigma^2[Rm]}.$$

So we now have that:

$$E_j = V_j \times R_F + \rho_{jm} \times \sigma_j \times \frac{(E[R_M] - R_F)}{\sigma[Rm]}$$

and therefore the value of the firm is:

$$V_j = \frac{1}{R_F}[E_j - \rho_{jm} \times \sigma_j \times \frac{(E[R_M] - R_F)}{\sigma[Rm]}].$$

An iso-value line represents combinations of E_j and $SCOR_{jm}$ with the same market value. From the last equation, iso-value lines are linear and parallel, with a slope equal to the market price of risk: $\frac{(E[R_M] - R_F)}{\sigma[Rm]}$.

In order to calculate the firm value, we can discount the zero-SCOR expected cash flows level (C) from the iso-value line at the risk free rate $R_F : V = \frac{C}{R_F}$.

[7] For more detailed proofs and explanations, see Boyer, Boyer and Garcia (2005).

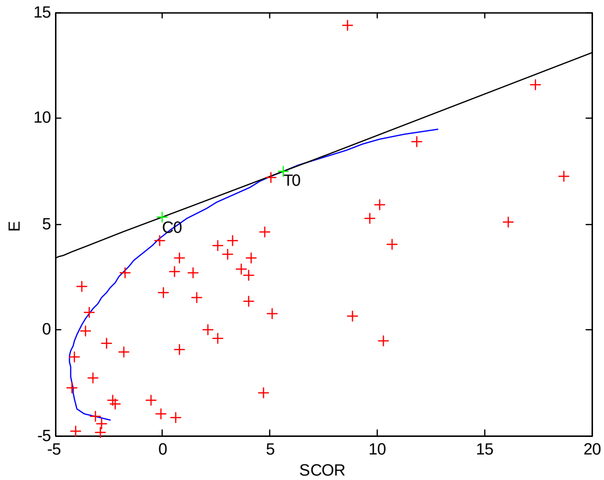

Figure 1 - Firm Valuation Example

In the figure above, there are 50 projects simulated in red and a frontier of possibilities in blue (here for the construction of the frontier we have defined bound constraints: each project represents between 0 and 15% of the final mix). The black line is the iso-value line defined by the market parameters (market return, volatility and the risk free rate). In the figure, T0 is the optimal combination and C0 is the zero-SCOR expected cash flows level, that we could use for a risk-neutral valuation ($FirmMarketValue = \frac{C0}{R_F}$). In this framework, all shocks in the market are translated into variations of the market parameters, and the firm must change its project combination in order to keep an optimal value[8]. Therefore, the firm should change its profile (more or less risky) after a variation of the risk premium, it is a sort of "Substitution Effect"[9]. We predict that a more flexible firm would change more its mix of activities following a shock in the market due to the concavity of its frontier of possibilities. We can also observe a "Revenue Effect" with the variation of the risk free rate as we use it to discount the risk neutral cash-flows of the firm[10].

In the BBG Model, the authors propose a decomposition of the real-assets-management activities of a firm by POM (production and operation management) and RRM (real-risk management) without the same goal (POM's goal is to raise expected cash flows and RRM's goal is to lower risk). They suggest some possible conflicts between these two entities and underline that the flexibility added through financial risk management could resolve this problem of coordination. In this paper, we adopt their valuation framework, then we

[8] See Proposition 1
[9] See Propositions 2 and 3
[10] See Proposition 4

consider the POM-RRM decomposition and the problem of coordination for the explanation of financial risk management.

2.2 BBG Model Propositions

In this subsection, we complete the analysis of the four propositions from the BBG paper:

Proposition 1 *"To maximize its value, a firm must equate its marginal rate of substitution, the rate at which it can substitute POM and RRM activities while remaining on its efficient frontier, to the market price of risk:*

$$-\frac{\partial(OM)}{\partial(RM)} = -\frac{\partial E}{\partial SCOR_M(CF_j,R_M)} \mid_{H(E,SCOR_M)=0} = \frac{(E[R_M]-R_F)}{\sigma[Rm]}. "$$

In other words, to maximize its value, a firm takes a combination of projects which is on the possibility frontier and tangent to the iso-value line. This is a project portfolio value maximization comparable to the one from asset management. To test this assumption, we need details on realized and possible firm projects. As it is really unlikely to obtain this very confidential information, we can not check this proposition.

Proposition 2 *"A firm reacts to an increase in the volatility of market returns, which reduces the price of risk, by modifying its RRM and POM activities to increase both its expected cash flows E and scaled correlation SCOR."*

Proposition 3 *"A firm reacts to an increase in the expected market return, which increases the price of risk, by modifying its RRM and POM activities to reduce both its expected cash flows E and scaled correlation SCOR."*

Proposition 4 *"An increase in the risk-free rate induces an increase in both the risk taken by a firm and its expected cash flows. Firm value increases if its original beta is larger than 1. When the original beta is less than 1, the direct effect is to lower firm value; a firm can alleviate and even reverse this direct effect by optimally adjusting its portfolio of projects."*

Through propositions 2, 3 and 4, we find a relation between the market price of risk variation and project portfolio management. The various market parameters used in these propositions can be grouped together by the risk premium (i.e. the market price of risk: $\frac{(E[R_M]-R_F)}{\sigma[Rm]}$) calculation. So the firm structure should be more(or less) risky for negative (or positive) variation of the risk premium. The firm structure represents the choice of projects by the firm, and a structure more risky means higher SCOR and expected cash flows.

From proposition 4, there is a relation between the firm market value, the risk free rate variation and the beta of the firm.

2.3 Flexibility & Financial Risk Management

From the BBG Model, the coordination problem from POM and ROM activities could explain the use of derivatives to reach the optimal project portfolio. Their valuation framework allows to observe the value added by financial risk management in case of coordination problems. As the firm structure (i.e. the project portfolio choice) moves with respect to the E-SCOR position, financial risk management brings smoothness in their state-position variation. We can omit coordination conflicts and consider that hedging allows more flexibility in the project portfolio management. Therefore, from the BBG model steams a new proposition that could be tested:

Proposition 5 *"There exists a positive relation between the firm structure flexibility (i.e. variations of firm's activities) and the use of derivatives."*

2.4 Theoretical Conclusion

From the study of this framework, we detect three relations that could be empirically observed:

- Project portfolio management & risk premium
- Firm value, its beta & risk free rate
- Firm structure flexibility & financial risk management

Hence, through this model we explore new assumptions for the valuation of a firm and its choices of activities. Then, we find a new determinant for the use of derivatives. In the next section, we empirically check these assumptions and confront the firm structure flexibility with other validated determinants for hedging explanation.

3 Empirical Analysis

3.1 Database & Methodology

The database was created from Compustat for accounting data, then Bloomberg and CRSP for market data. The sample is composed of firms from the US S&P500 selected in 2004. Firms lacking important data have been dropped from the sample. The final sample is made of 464 enterprises. The database was extracted for the years 1993 to 2004. Concerning the Flexibility Factor determination, only firms with complete data for the all time segment were retained. Thus, the final sample for this subsection represents 270 enterprises; hedging, managerial[11] shareholding and option ownership data were extracted from EDGAR US Database. Finally, for this empirical study, Matlab, Stata and Excel softwares were used.

All the market data are selected at end of the year (example: 12/31/2004 for the year 2004), and the expected value is estimated by the realized one (hypothesis of perfect forecast). For instance, we consider the operating income reported in the annual report for the estimation of expected cash flows.

3.2 Risk Premium - Firm Structure

3.2.1 Market Data

Date	TB 1month	Volatility	Return	Risk Premium	V1. Risk Premium	V2. Risk Premium
1993	2.94%	8.68%	7.06%	47.42%		
1994	4.74%	9.93%	-1.54%	-63;19%	-233.26%	-110.61%
1995	4.58%	7.88%	34.11%	374.72%	692.98%	437.91%
1996	4.87%	11.88%	20.26%	129.51%	-65.44%	-245.21%
1997	5.11%	18.36%	31.01%	141.08%	8.93%	11.57%
1998	4.39%	20.62%	26.67%	108.03%	-23.42%	-33.05%
1999	5.10%	18.26%	19.53%	79.01%	-26.86%	-29.02%
2000	5.77%	22.33%	-10.14%	-71.24%	-190.17%	-150.26%
2001	1.64%	22.08%	-13.04%	-66.47%	6.71%	4.78%
2002	1.14%	26.07%	-23.37%	-94.00%	-41.42%	-27.53%
2003	0.83%	17.23%	26.38%	148.31%	257.77%	242.31%
2004	1.91%	11.19%	8.99%	63.29%	-57.33%	-85.02%

Table 1 - Risk Premium[12]

[11] For the determination of managerial shareholding and option ownership, we analyse the portfolio of the top five executives of the firm.

[12] In our paper, we use a risk premium by unit of volatility but denote it simply risk premium.

Note: TB means T-Bills (we select TB 1 Month as the risk free rate). Market Volatility and Market Return are calculated from the US S&P500 return. Market Volatility is an historical volatility calculated with n equals 260 (equivalent for the number of trading days in a year). The risk premium, and its variations are calculated as follows:

$$RP = \frac{R_M - R_F}{\sigma[Rm]}$$

$$V1.RP_t = \frac{RP_t - RP_{t-1}}{|RP_{t-1}|}$$ [13]

$$V2.RP_t = RP_t - RP_{t-1}$$

Since the market return is on the nominator and the market volatility is on the denominator in RP calculation, we select years where variations of the market volatility and return have opposite signs in order to obtain the same expectation from propositions 2 and 3 relating to E[CF] and SCOR variations. Thus, we will study the following years: 1994, 1995, 1996, 2000, 2002 and 2003.

3.2.2 E[CF] and SCOR Variations Analysis[14]

	1994	1995	1996	2000	2002	2003
V.Om sign	+	-	+	+	+	-
V.Rm sign	-	+	-	-	-	+
V.SCOR & CF, expected sign	+	-	+	+	+	-
N total	290	307	320	407	442	460
Mean V.SCOR	0.41	0.22	3.24	2.42	0.84	0.21
Mean V.CF	0.25	0.20	0.46	0.34	0.91	0.26
t-Test Mean V.SCOR=0	>0	>0	>0	>0	>0	
t-Test Mean V.CF=0	>0	>0	>0	>0		>0

Table 2 - SCOR & CF Variations: Statistics Results

Note: V.Om and V.Rm are the Market Volatility and Return variations. V.SCOR and V.CF are estimated with the following equation (absolute value in the denominator to keep the direction of the variation as SCOR and the operating income could be negative): $V.X_t = \frac{X_t - X_{t-1}}{|X_{t-1}|}$. For the t-Test, the validated alternative is written (there is a blank if no conclusion could be made on the sign of the variation with a 90% confidence level).

The expected cash flows of the firm are estimated as the operating income from the annual report. The SCOR is hard to estimate as it is the product of the cash flows standard deviation with the correlation between the cash flows and the market return. As it is proved below, we can estimate the SCOR of the

[14] Distribution estimations for CF and SCOR variations by the kernel-gaussian estimation method are set in the appendix.

firm from its beta, its market value and the market volatility, which are easy to find. Firm market value is the total number of shares times the stock price.

$$\mathbf{SCOR}\,[CF_i, R_m] = \sigma\,[CF_i] \times Corr\,[CF_i, R_m] = \sigma\,[CF_i] \times \frac{Cov[CF_i, R_m]}{\sigma[CF_i]\ \times\ \sigma[Rm]}$$

$$= \sigma\,[CF_i] \times \frac{FirmMarketValue^i \times Cov[R_i, R_m]}{\sigma[CF_i]\ \times\ \sigma[Rm]}$$

$$= FirmMarketValue^i \times \sigma\,[Rm] \times \frac{Cov[R_i, R_m]}{\sigma^2[Rm]}$$

$$= FirmMarketValue^i \times \sigma\,[Rm] \times \beta_{im}$$

It should be a growth effect as all means of V.SCOR and V.CF are positive (bear in mind that there is censure bias because we observe only firms that have survived till 2004). V.SCOR's means are by far lower when the predicted sign is negative and for V.CF, it is the same (except for 2004). It seems that the data are in the direction of our theoretical relation, but more precise work is needed to validate it. In the next subsection, we decompose the risk premium variation in its three market parameters and so we control for their different variations.

3.2.3 Panel Data Analysis

In this subsection (and the one in the Risk Free Rate - Market Value), we adopt two different assumptions on how the firm adapts its activities:

- V.$X_t = X_t - X_{t-1}$: there is an instant adaptation of the firm.
- V.$X_t = X_{t-1} - X_{t-2}$: the firm adapts its activities based on the market parameters variations of the previous year.

We use a Panel-Probit Model with the SCOR (then CF) variation as dependant variable (= 1 if V.$SCOR \geq 0$ (then if V.$CF \geq 0), = 0$ elsewise) and the variations of the Risk Free Rate, Market Return and Volatility as independant variables.

		V.X_t=X_t-X_{t-1}		V.X_t=X_{t-1}-X_{t-2}	
	Predicted Sign	Coefficient	Pvalue	Coefficient	Pvalue
V.Rf	+	2.51	0.055	6.64	0.000
V.Rm	-	1.17	0.000	0.43	0.001
V.Om	+	11.60	0.000	5.66	0.000
		Chi-Square	Pvalue	Chi-Square	Pvalue
		459.87	0.000	119.13	0.000

Table 3 - SCOR: Panel-Probit Results

	Predicted Sign	$V.X_t$=X_t-X_{t-1} Coefficient	Pvalue	$V.X_t$=X_{t-1}-X_{t-2} Coefficient	Pvalue
V.Rf	+	18.37	0.000	10.80	0.000
V.Rm	-	0.32	0.005	0.85	0.000
V.Om	+	1.28	0.026	0.46	0.552
		Chi-Square	Pvalue	Chi-Square	Pvalue
		171.49	0.000	109.43	0.000

Table 4 - CF: Panel-Probit Results

In both cases, the sign observed for V.Rm is the opposite to the one predicted. Therefore, with our results we can not conclude about the relation between the firm structure and the risk premium. However, our statistics presented in 3.2.2 lead us to believe that there may exist a relation and we need to adopt a more sophisticated approach for the determination of how the firm adapts its activities. For instance, the firm could predict the market parameter and react in function of the predicted value and the value of the previous period: V.$X_t = \widehat{X_t} - X_{t-1}$. The prediction would be based on the model used in the industry, for instance a GARCH (1,1) for the prediction of the volatility.

3.3 Risk Free Rate - Market Value

3.3.1 Market Data

Date	TB 1month	TB 3months	FED Target Rate	V. TB 1month
1993	2.94%	3.05%	3.00%	
1994	4.74%	5.64%	5.50%	60.84%
1995	4.58%	5.05%	5.50%	-3.23%
1996	4.87%	5.14%	5.25%	6.37%
1997	5.11%	5.31%	5.50%	4.80%
1998	4.39%	4.43%	4.75%	-13.98%
1999	5.10%	5.33%	5.50%	16.11%
2000	5.77%	5.84%	6.50%	13.07%
2001	1.64%	1.71%	1.75%	-71.64%
2002	1.14%	1.19%	1.25%	-30.56%
2003	0.83%	0.93%	1.00%	-27.20%
2004	1.91%	2.22%	2.25%	130.71%

Table 5 - Risk Free Rate

1994, 2001 and 2004 are the years with the greatest variations, and 2001 is the best year to observe the market value variation as the market volatility and return are not so far from being constant (see Risk Premium Table). So in 2001, we almost control for the two other parameters of the risk premium and should observe only the risk free rate effect on firm market value.

3.3.2 Market Value Variation Analysis

	1994	2001	2004
V.MV Expected sign, beta<1	-	+	-
V.MV Expected sign, beta>1	+	-	+
N, beta<1	135	240	210
N, beta>1	171	204	254
N total	306	444	464
Mean V.MV, beta<1	-0.0055	0.0796	0.1940
Mean V.MV, beta>1	0.1119	0.0180	0.1990
Proportion V.MV>0, beta<1	44.44%	52.08%	83.81%
Proportion V.MV>0, beta>1	58.48%	45.59%	71.26%
t-Test difference V.MV beta<1 - V.MV beta>1	<0	>0	
t-Test Mean V.MV=0, beta<1	<0	>0	>0
t-Test Mean V.MV=0, beta>1	>0		>0

Table 6 - Market Value Variation: Statistics Results

Note: MV is the Market Value, and V.MV$_t$=$\frac{MV_t - MV_{t-1}}{MV_{t-1}}$. For the t-Test, the validated alternative is written (there is a blank if no conclusion could be made on the sign of the variation with a 90% confidence level).

For 2001, we observe the theoretical assumption: the proportion of firms with a positive market value variation is higher for firms with a beta lower than 1. For 1994, the expectation is also correct but not for 2004 (but the risk premium variation was high in this year). So to complete this study, we need regressions to control for the different parameters of the risk premium.[15]

3.3.3 Linear Regression

	1994	2001	2004
Expected B sign	+	-	+
B beta	0.053	-0.050	-0.064
Pvalue	0.311	0.234	0.098
R-square	0.3273	0.0645	0.1451
B betasup1	0.020	-0.035	-0.037
Pvalue	0.509	0.444	0.214
R-square	0.3224	0.0611	0.1407

Table 7 - Regression Analysis

Two regressions (with robust residuals) are done:

$\Delta FirmMarketValue^i = \alpha_0 + B \times \beta^i + \alpha' \times X^i + \varepsilon^i$

$\Delta FirmMarketValue^i = \alpha_0 + B \times \delta^i + \alpha' \times X^i + \mu^i$, with $\delta^i = 1$ if $\beta^i > 1$ and $= 0$ elsewise.

X^i is the vector of controling variables: dividend variation, dividend yield, cash flows variation, book-market value ratio, long term debt-market value ratio, sales variation and total assets. B represents the regression coefficient of the dummy δ (B betasup1) or of β (B beta).

For 1994 and 2001 the results are coherent with the theoretical relation, but not for 2004. Even if we control for individual characteristics, we must take into account the risk premium effect to indepth this study.

[15] Distribution estimations for the Market Value variation by the kernel-gaussian estimation method are set in the appendix.

3.3.4 Panel Data Analysis

We use a Panel-Probit Model with the Firm Market Value variation as dependant variable (= 1 if $\Delta MV \geq 0$, = 0 elsewise) and the variations of the Risk Free Rate (with a coefficient value depending on the beta value), Market Return and Volatility as independant variables. We proceed by making two models, the first one with a decomposition if the beta is superior or inferior than the unity, and the second one with more gradual partitions. For the predicted signs of the ΔRm and ΔOm coefficients, we study the effect of these market parameter variations on discounted CF and so the firm value with the figure "Firm Valuation Example" in 2.1.

		V.X_t=X$_t$-X$_{t-1}$		V.X_t=X$_{t-1}$-X$_{t-2}$	
	Predicted Sign	Coefficient	Pvalue	Coefficient	Pvalue
V.Rf beta<1	-	9.68	0.000	16.36	0.000
V.Rf beta>1	+	14.90	0.000	27.93	0.000
V.Rm	-	1.17	0.000	0.43	0.000
V.Om	+	11.60	0.034	5.66	0.000
		Chi-Square	Pvalue	Chi-Square	Pvalue
		343.03	0.000	323.77	0.000
V.Rf beta<0.5	- -	10.20	0.000	11.70	0.003
V.Rf 0.5<beta<1	-	9.36	0.000	17.55	0.000
V.Rf 1<beta<1.5	+	12.67	0.000	26.46	0.000
V.Rf beta>1.5	+ +	18.02	0.000	31.09	0.000
V.Rm	-	1.73	0.000	1.22	0.000
V.Om	+	-1.15	0.300	3.76	0.000
		Chi-Square	Pvalue	Chi-Square	Pvalue
		344.70	0.000	324.52	0.000

Table 8 - Market Value: Panel-Probit Results

Depending on the firm's adaptation assumption, we observe either the inverse sign of the prediction for ΔRm and ΔOm coefficients or only for ΔRm coefficient. Thus, we can not validate the implication of BBG Model on the relation between the firm market value and the market parameters. However, given the results in 3.3.2, 3.3.3 and 3.3.4, we observe empirical evidences in favor of a relation between the risk free rate, the market value of the firm and its beta. Firms with a higher beta seem to react more to a variation of the risk free rate[16] but we can not conclude whether there is a difference on the sign of the market value variation depending on the firm's beta. We need a more

[16] At first sight, this result seems obvious since the beta is the measure of how the firm's stock price reacts to variations in the market, but by definition beta is just correlated with the market return, so we do not know exactly the relation with the risk free rate.

sophisticated model to conclude seriously; we can modify the firm's adaptation assumption, and take into account one with a predicted value of the market parameters as proposed in 3.2.3.

3.4 Firm Structure Flexibility - Corporate Hedging

3.4.1 Firm Structure Flexibility Factor

First, we need to evaluate the position variation of the firm structure. We used two methods to estimate this variation, the distance between the two combinations in the CF-SCOR space and the curvature of the frontier of possibilities.

- Distance between two positions:

$$VP1_t = \sqrt{|SCOR_t - SCOR_{t-1}|^2 + |CF_t - CF_{t-1}|^2} / FirmMarketValue_t$$

- Curvature of the frontier of possibilities:

$$VP2_t = \frac{CF_t - CF_{t-1}}{SCOR_t - SCOR_{t-1}} / FirmMarketValue_t$$

Second, we calculate the risk premium (RP) also with two methods:

$$V1RP_t = \frac{RP_t - RP_{t-1}}{|RP_{t-1}|}$$

$$V2RP_t = RP_t - RP_{t-1}$$

Finally, we regress the firm structure variation on the risk premium variation, thus we have four different regressions:

$$VP._t^i = \beta_0 + \beta_1^i \times V.RP_t + \varepsilon_t^i$$

β_1^i represents the Flexibility Factor or the sensibility of the firm structure to variations in the risk premium.

	VP1V1RP	VP1V2RP	VP2V1RP	VP2V2RP
VP1V1RP	1.0000			
VP1V2RP	0.9251	1.0000		
VP2V1RP	0.0117	0.0083	1.0000	
VP2V2RP	0.0242	0.0236	0.9104	1.0000
Beta 2004	-0.1427	-0.2498	0.0560	0.0517
Beta 2001	-0.2892	-0.3852	0.0100	0.0140
Beta 1994	-0.1347	-0.1948	0.0529	0.0771
Assets 2004	0.0405	0.0594	0.0267	0.0398
Assets 2001	0.0506	0.0642	0.0252	0.0370
Assets 1994	0.0816	0.0894	0.0154	0.0303
Mvalue 2004	0.0204	0.0603	-0.0021	0.0157
Mvalue 2001	0.0150	0.0562	-0.0029	0.0116
Mvalue 1994	0.0257	0.0620	-0.0002	0.0143
DivYield2004	0.0056	0.0526	0.0068	0.0179
BV/MV 2004	0.0079	-0.0648	0.0912	0.0400
SCOR 2004	0.0040	0.0310	-0.0023	0.0162
CF 2004	0.0626	0.0899	0.0067	0.0206

Table 9 - Flexibility Factor - Correlation Table

Through the study of the correlation table, we observe that VP1V2RP (i.e.β_1^i from the regression $VP1_t^i = \beta_0 + \beta_1^i \times V2RP_t + \varepsilon_t^i$) is the best estimator for the firm structure flexibility:

- Beta: there should be a negative relation between the beta of the firm and its flexibility factor. A firm that can change its activities easily after a change in the market (i.e. a variation of the risk premium) should be less "risky", this is translated into a lower beta. As proposed by Stulz (2004), a firm can become more flexible so that it has lower fixed costs in a cyclical downturn. It is coherent with the correlation analysis, VP1V2RP is more negatively correlated in 2001.
- Size effect: a big firm should be more flexible as they have more projects and so a more concave frontier of possibilities. Here it is estimated by the positive correlation with the firm market value and the firm total assets (mv and assets).
- Growth opportunities: we can estimate the investment or growth opportunities by the ratio $\frac{FirmMarketValue}{FirmBookValue}$, here we observe a negative correlation with the inverse of this ratio (BVMV2004). It is coherent with the intuition that a more flexible firm should have more investment opportunities.

Therefore, we select VP1V2RP as the flexibilitor factor.

3.4.2 Corporate Hedging Variable

In this paper, we consider the use of derivatives as the only tool for hedging. We do not estimate "natural" hedging tools like foreign denominated debt in substitution of currency Swap or the fact that cash outflows and inflows are synchronized.

To evaluate the use of derivatives, there are three instruments: a dummy for hedging or not, the total notional value and the fair market value of derivatives. These informations are included in the annual report; the database was extracted from EDGAR. The most reliable estimator is the last one as it is the actual value of the firm position and it is not positively biased as the notional value (because short and long positions have contrary financial effects and so the net position could be null).

Therefore, our explained variable for the level of hedging is:

$$FRM = \frac{FairMarketValueOfDerivatives}{TotalAssets}$$

We will also study the level of hedging with the absolute value of the previous variable.

Then, we will consider the decision of hedging with a dummy (= 1 if the firm is hedged, = 0 elsewhere) and also if the firm is hedged for the following risk: foreign exchange (currency), debt financing (interest rate), commodity and equity.

3.4.3 Other Explanatory Variables[17]

The literature gives us several determinants for the use of derivatives:

- Risk aversion of the managers (*managerial shareholding* [+] and *managerial option ownership* [-])

- Investment or growth opportunities ($\frac{Market\ Value}{Book\ Value}$ [+] and $\frac{R\&D\ Expenses}{Total\ Assets}$ [+])

- Firm size (*Total Assets* [+])

- Financial distress cost ($\frac{Long\ Term\ Debts}{Market\ Value}$ [+])

[17] Note that in parenthesis are variables we used to estimate determinants and in brackets are predicted signs of the relation between determinants and the use of derivatives

- Dividend distributed (*Dividend Yield* [+])

- Firm liquidity (*Quick Ratio*: $\frac{Current\ Assets\ -\ Inventories}{Current\ Liabilities}$ [-])

- Currency rate ($\frac{Foreign\ Sales}{Total\ Sales}$ [+])

- Tax credits ($\frac{Net\ Operating\ Loss\ Carry\ Forward}{Total\ Assets}$ [+])

- Industry effect (dummy industry, we will use it as a control variable and so we do not analyse the predicted relation in respect of the industry type)

3.4.4 Level of Hedging

In subsections 3.4.4, 3.4.5 and 3.4.6, we censor the finance industry since their quick ratio and foreign sales are calculated differently. Thus, our sample for these subsections represents 238 firms with 190 firms hedged. Moreover all econometric results are presented with and without control of the industry (binary variable for each type of industry).

In order to study the level of hedging of the firm, we use a Heckman selection model. The first step is the decision of hedging or not, then for the ones who decide to use derivatives, the second step is the determination of the level of hedging (i.e. fair value of derivatives divided by total assets).

	Predicted sign	Not controlled by industry: Coefficient	Pvalue	Controlled by industry: Coefficient	Pvalue
1) DECISION					
Flexibility	+	11.50	0.348	6.57	0.620
Log(Assets)	+	0.32	0.024	0.26	0.068
DividendYield	+	-0.001	0.847	-0.001	0.902
MV / BV	+	0.01	0.774	0.04	0.266
LT Debt / MV	+	0.06	0.546	-0.01	0.803
R&D / Assets	+	-2.25	0.480	-3.93	0.243
Quick Ratio	-	-0.19	0.033	-0.20	0.024
FgSales / Sales	+	1.72	0.001	1.69	0.004
NOL / Assets	+	3.42	0.209	4.01	0.176
Log (MngShare)	+	-0.02	0.755	-0.03	0.625
Log(MngOption)	-	-0.15	0.066	-0.14	0.120
2) LEVEL					
Flexibility	+	-0.47	0.515	-0.19	0.784
Log(Assets)	+	0.001	0.809	0.004	0.460
DividendYield	+	-0.0001	0.474	-0.0002	0.409
MV / BV	+	0.00005	0.723	0.00005	0.703
LT Debt / MV	+	-0.0007	0.509	-0.0006	0.570
R&D / Assets	+	0.17	0.265	0.18	0.262
Quick Ratio	-	0.01	0.041	0.01	0.032
FgSales / Sales	+	-0.006	0.864	0.002	0.927
NOL / Assets	+	-0.09	0.222	-0.07	0.261
Log (MngShare)	+	-0.004	0.217	-0.004	0.187
Log(MngOption)	-	0.001	0.741	0.0006	0.850
		Chi-Square	Pvalue	Chi-Square	Pvalue
		50.29	0.0005	1066.38	0.0000

Table 10 - Heckman Selection Model - Two Step Estimates

Analysis of the decision of hedging or not will be done in next subsection. Here for the level of hedging we only observe the Quick Ratio as significant variable at a 3% level.

Finally we use a Tobit Model to analyse the absolute value of the level of hedging as there is a boundary constraint at 0.

	Predicted sign	Not controlled by industry		Controlled by industry	
		Coefficient	Pvalue	Coefficient	Pvalue
Flexibility	+	0.11	0.852	0.06	0.911
Log(Assets)	+	0.01	0.028	0.01	0.054
DividendYield	+	-0.0002	0.323	-0.0002	0.400
MV / BV	+	0.0001	0.430	0.0001	0.462
LT Debt / MV	+	0.0006	0.536	-0.0006	0.552
R&D / Assets	+	0.10	0.446	0.11	0.426
Quick Ratio	-	0.001	0.700	0.001	0.691
FgSales / Sales	+	0.04	0.040	0.03	0.108
NOL / Assets	+	-0.06	0.376	-0.06	0.382
Log (MngStock)	+	-0.004	0.112	-0.005	0.100
Log(MngOption)	-	-0.002	0.447	-0.001	0.678
		Pseudo R-square		Pseudo R-square	
		-0.0365		-0.0520	

Table 11 - Tobit Estimates

There is only the size effect significant at 5%. Therefore, through these two models, we do not have conclusive remarks and we will focus on the decision of hedging in the following subsections.

3.4.5 Decision of Hedging by type of risk

To analyse the decision of hedging (in general or by type of risk) we use a Probit model (i.e. = 1 if the firme is hedged, = 0 elsewise).

	Predicted sign	Not Controlled by Industry		Controlled by Industry	
		Coefficient	Pvalue	Coefficient	Pvalue
Flexibility	+	11.5068	0.312	6.571987	0.591
Log(Assets)	+	0.3216768	0.023	0.2641823	0.052
DividendYield	+	-0.0014458	0.728	-0.0010982	0.824
MV / BV	+	0.0120769	0.692	0.0465467	0.070
LT Debt / MV	+	0.0675131	0.524	-0.0171553	0.607
R&D / Assets	+	-2.25837	0.489	-3.930239	0.246
Quick Ratio	-	-0.1919256	0.026	-0.2073532	0.019
FgSales/Sales	+	1.721713	0.000	1.695177	0.001
NOL / Assets	+	3.428797	0.091	4.012649	0.074
Log (MngShare)	+	-0.0215893	0.727	-0.0391059	0.586
Log (MngOption)	-	-0.155596	0.039	-0.147289	0.078
		Pseudo R-square 0.1864		Pseudo R-square 0.2432	

Table 12 - Hedging - Probit Estimates

We found six significant coefficients at a 10% level and coherent with their predicted sign. These determinants have already been empirically validated, so this is an indication that our database respects results from the literature.

Now, we will decompose the decision of hedging for four different risks. In this way, firms could use derivatives for foreign exchange risk (currency risk), debt financing risk (interest rate risk), commodity risk and equity risk (stock price of their investments).

	Predicted sign	Not Controlled by Industry		Controlled by Industry	
		Coefficient	Pvalue	Coefficient	Pvalue
Flexibility	+	6.72731	0.549	3.528217	0.761
Log(Assets)	+	0.0182462	0.873	0.0692736	0.575
DividendYield	+	0.0120924	0.143	0.0108115	0.223
MV / BV	+	-0.002438	0.204	-0.0031078	0.092
LT Debt / MV	+	0.0088812	0.597	0.0102492	0.515
R&D / Assets	+	1.8561214	0.585	-0.2841436	0.935
Quick Ratio	-	-0.25965	0.008	-0.2523647	0.009
FgSales / Sales	+	3.154949	0.000	2.767154	0.000
NOL / Assets	+	6.884948	0.024	5.838456	0.049
Log (MngShare)	+	0.0352815	0.552	0.0514244	0.422
Log (MngOption)	-	0.0004915	0.994	-0.0024615	0.973
		Pseudo R-square 0.2786		Pseudo R-square 0.3128	

Table 13 - Foreign Exchange Risk - Probit Estimates

As expected, the foreign exposition (Foreign Sales / Sales) is the most significant coefficient for the decision of currency hedging.

	Predicted	Not Controlled by Industry		Controlled by Industry	
	sign	Coefficient	Pvalue	Coefficient	Pvalue
Flexibility	+	-4.155881	0.705	-7.975913	0.464
Log(Assets)	+	0.4263028	0.001	0.3745493	0.003
DividendYield	+	0.0105719	0.191	0.0132397	0.148
MV / BV	+	0.0036536	0.838	0.010641	0.588
LT Debt / MV	+	0.026474	0.623	0.0158687	0.655
R&D / Assets	+	-10.04877	0.002	-10.12231	0.002
Quick Ratio	-	-0.1379954	0.157	-0.156353	0.125
FgSales / Sales	+	0.6127013	0.157	0.4963386	0.295
NOL / Assets	+	0.8485563	0.472	1.011427	0.407
Log (MngShare)	+	0.0037981	0.951	-0.0084541	0.905
Log (MngOption)	-	-0.1178394	0.085	-0.104035	0.148
		Pseudo R-square		Pseudo R-square	
		0.2162		0.2170	

Table 14 - Debt Financing Risk - Probit Estimates

We notice two unexpected results here: first, the R&D coefficient is the most significant but not with the expected sign, and second the leverage coefficient is not significant for the decision of interest rate hedging.

	Predicted	Not Controlled by Industry		Controlled by Industry	
	sign	Coefficient	Pvalue	Coefficient	Pvalue
Flexibility	+	40.89356	0.010	45.90117	0.020
Log(Assets)	+	0.4622247	0.000	0.5031496	0.001
DividendYield	+	-0.0296471	0.013	-0.0451429	0.003
MV / BV	+	0.0014883	0.480	0.0023692	0.306
LT Debt /MV	+	-0.0181029	0.375	-0.0281866	0.222
R&D / Assets	+	-16.97719	0.001	-13.49775	0.003
Quick Ratio	-	-0.0594772	0.644	-0.102821	0.463
FgSales / Sales	+	0.2903347	0.529	0.1185039	0.817
NOL / Assets	+	0.002941	0.999	-0.0667766	0.964
Log (MngShare)	+	-0.1833148	0.014	-0.1686922	0.067
Log (MngOption)	-	-0.1039251	0.202	-0.0378697	0.706
		Pseudo R-square		Pseudo R-square	
		0.2197		0.3430	

Table 15 - Commodity Risk - Probit Estimates

Finally, for commodity risk, we observe the flexibility factor significant at a 2% level with the predicted sign. We also notice that the sign of the dividend yield coefficient is negative and significant. The theory behind the prediction of a positive sign is based on a lack of liquidity after a dividend payout, and therefore an incentive to hedge due to financial distress cost. But we already estimate the liquidity effect with the Quick Ratio, thus the dividend yield could be perceived as an estimator of growth opportunities[18]. The ratio Market Value / Book Value is an estimator of growth opportunities established by financial markets but the dividend yield is an internal signal made by the firm. So, the dividend yield has a dual effect on the corporate hedging decision, and this negative sign has a financial analysis explanation.

		Not Controlled by Industry		Controlled by Industry	
	Predicted sign	Coefficient	Pvalue	Coefficient	Pvalue
Flexibility	+	42.79679	0.011	29.05127	0.063
Log(Assets)	+	0.462395	0.005	0.5087596	0.002
DividendYield	+	-0.0018588	0.673	-0.0095536	0.107
MV / BV	+	-0.0058059	0.788	-0.0011117	0.968
LT Debt / MV	+	-0.0059715	0.864	-0.0131152	0.725
R&D / Assets	+	6.376253	0.037	4.967401	0.123
Quick Ratio	-	0.1109778	0.197	0.0713692	0.425
FgSales / Sales	+	-0.3156646	0.564	-0.3033991	0.640
NOL / Assets	+	2.322472	0.167	2.233997	0.194
Log (MngShare)	+	0.0106017	0.904	0.0661194	0.515
Log (MngOption)	-	0.0077272	0.940	-0.0332903	0.748
		Pseudo R-square 0.1605		Pseudo R-square 0.1732	

Table 16 - Equity Risk - Probit Estimates

The flexibility factor is significant at a 6% level and we observed also a size effect. The equity risk represents the firm's investment and mostly the subsidiaries traded on financial markets.

Through these tables, we observed empirical evidences of the significant determinants variations in accordance with the sort of risk. Therefore, even if we control for the type of industry, each kind of risk has specific determinants. The decomposition of the type of risk hedged (instead of just considering if the firm is hedged or not) could lead financial analysts to a better evaluation of the firm management and of financial risk management motivations.

[18] See Gaver & Gaver (1993), and Smith & Watts (1992).

3.4.6 Number of risks hedged

In connection with the type of risk decomposition considered previously, we study now the number of risks hedged by the firm. First, we consider all the four risks presented before: financing, currency, commodity and equity risk. Firms could hedge between 0 and 4 sorts of risk; therefore, we use an Ordered Probit Model to estimate the number of risks hedged as it is a ranked discrete dependant variable.

		Not Controlled by Industry		Controlled by Industry	
	Predicted sign	Coefficient	Pvalue	Coefficient	Pvalue
Flexibility	+	17.7106	0.027	11.84588	0.140
Log(Assets)	+	0.4311984	0.000	0.4313938	0.000
DividendYield	+	-0.0013261	0.562	-0.0033614	0.150
MV / BV	+	0.0006078	0.569	0.0003143	0.763
LT Debt / MV	+	0.0005298	0.958	0.0012068	0.904
R&D / Assets	+	-3.659068	0.079	-3.693538	0.101
Quick Ratio	-	-0.1307459	0.079	-0.1648271	0.032
FgSales / Sales	+	1.289239	0.000	1.01267	0.002
NOL / Assets	+	1.860814	0.020	1.910121	0.150
Log (MngShare)	+	-0.0434452	0.383	-0.204212	0.708
Log (MngOption)	-	-0.0694944	0.179	-0.0490349	0.377
		Pseudo R-square 0.1175		Pseudo R-square 0.1474	

Table 17 - Every Risk - Ordered Probit Estimates

We recognize three significant factors frequently validated in the empirical literature: size, liquidity and foreign exposure.

Second, we analyse the number of operational risks hedged. Since operational risk is related to operations and not financing, we consider only currency, commodity and equity risk. Here, firms could hedge between 0 and 3 sorts of risk, so we also use an Ordered Probit Model to estimate the number of operational risks hedged.

		Not Controlled by Industry		Controlled by Industry	
	Predicted sign	Coefficient	Pvalue	Coefficient	Pvalue
Flexibility	+	25.06966	0.004	18.64157	0.025
Log(Assets)	+	0.3290411	0.000	0.3344728	0.001
DividendYield	+	-0.0023691	0.403	-0.0053856	0.021
MV / BV	+	-0.0012558	0.289	-0.0016622	0.150
LT Debt / MV	+	-0.0050441	0.584	-0.0044866	0.625
R&D / Assets	+	-0.4415766	0.837	-0.6505316	0.781
Quick Ratio	-	-0.096191	0.180	-0.1296876	0.076
FgSales / Sales	+	1.51316	0.000	1.238986	0.000
NOL / Assets	+	1.973128	0.058	2.032038	0.048
Log (MngShare)	+	-0.0594358	0.271	-0.0161126	0.787
Log (MngOption)	-	-0.0439379	0.464	-0.0211147	0.743
		Pseudo R-square 0.1149		Pseudo R-square 0.1638	

Table 18 - Operational Risk - Ordered Probit Estimates

For operationnal risk, at a 5% level we have size, dividend yield (with a negative relation as explained in 3.4.5), liquidity, foreign exposure and finally flexibility as significant factors. This result is intuitive since flexiblity is more related to firm activities (i.e. foreign exchange, commodity and equity risk) and not to financing decision (i.e. debt financing risk).

3.4.7 Industry Analysis

We have used a market value weight for each industry (i.e. $FirmMarketValue$ / $IndustryMarketValue$), in order to calculate the mean of the variables below. Then we have ranked these industries by the Flexibility Factor (the most flexible industry is at the top). Note that the non-classified industry is composed by only two firms: GE and Textron.

Industry	Flexibility	# Risk	# Op. Risk	Hedging	FX	Debt	Comm	Equity	FV/Assets	Abs FV/Assets
Utility	-0.0023	2.111	1.206	1	0.433	0.906	0.755	0.018	0.00243	0.00714
Food	-0.0032	2.622	1.758	1	0.982	0.864	0.530	0.246	0.01137	0.01379
Non-Classified	-0.0035	3	2	1	1	1	0	1	0.00349	0.00349
Mining	-0.0039	2.043	1.208	0.937	0.656	0.835	0.552	0	-0.00564	0.00896
Financial	-0.0042	2.0675	1.13031	0.93718	0.515	0.9372	0.21223	0.4029	0.00799	0.0089706
Service	-0.0044	2.462	1.673	0.912	0.882	0.789	0.013	0.777	-0.00178	0.00567
Retail	-0.0049	1.293	0.619	0.713	0.522	0.674	0.059	0.039	0.00052	0.00181
Wholesale	-0.0053	1.030	0.163	0.867	0	0.867	0.163	0	-0.00012	0.00062
Manufacturing	-0.0054	1.6086	1.02826	0.83326	0.792	0.5803	0.10863	0.1275	0.025292	0.0272999
Communication	-0.0067	1.521	0.521	1	0.521	1	0	0	0.00142	0.00171
Transportation	-0.0092	1.824	0.824	1	0.464	1	0.360	0	0.01087	0.01087
Construction	-0.0101	1	0.401	1	0.401	0.599	0	0	0.00089	0.00151

Table 19 - Industry Estimates

We observe a clear dichotomy for the number of risks (total and operationnal) hedged. The six most flexible industries are the ones which have more types of risk hedged. This analysis by type of industry supports the fact that more flexible firms as we have calculated (i.e. firm structure sensibility to variations of the risk premium) hedge a higher number of risks.

4 Conclusion

In this paper, we have empirically examined three theoretical propositions based on the BBG Model, namely: project portfolio management linked to variations of the risk premium, stock price variation explained by the risk free rate depending on firm beta, and firm flexibility as a new determinant of corporate hedging decision.

Concerning the link between the choice of projects and the risk premium, we found no empirical evidence that could validate it, but as exposed in 3.2.2, basic statistics deliver some hope for the existence of a relation. Further research is needed, and one of the possible extensions could consist of the estimation of the firm adaptation mechanism by predicted value of market parameters.

The same conclusion applies for the second theoretical proposition, if we consider every market parameter of the risk premium. However, our empirical results show a relation between firm value, its beta and the risk free rate. It seems that firms with higher beta have their stock price more sensible to risk free rate variations.

We have constructed an estimator for firm flexibility (i.e. firm structure sensibility to variations of the risk premium), and found evidence for the explanation of the number of operational risks hedged by the Flexibility Factor. Through an industry analysis, we reinforce our prediction : industries more flexible hedge a higher number of risks.

We have also detected that the dividend yield could be an estimator of growth opportunities in a financial risk management framework. Finally, this study leads us to state that each kind of risk has specific determinants.

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5 Appendix

- **Theoretical Literature Review:**

Theoretical Incentives for Corporate Hedging	Author(s) of Study
Managerial Risk Aversion	Smith&Syulz 1985 Stulz 1984
Assymetrical Information between Managers and Investors (Agency cost and equity issuance cost)	Breeden&Viswanathan 1998 DeMarzo&Duffie 1993 Myers 1977
Lack of Alternative to Hedging within Firms	Nance 1993 Stulz 1996
Fewer Regulation (Regulation lower the contracting cost of investment)	Barclay&Smith 1995 Mian 1996 Smith&Watts 1992
Convex Tax Function (Minimize tax liability)	Graham&Smith 1999 Mayers&Smith 1987 Mian 1996 Smith&Stulz 1985 Stulz 1996
Reduce the Expected Costs of Financial Distress (Reducing the volatility of earnings)	Mayers&Smith 1987 Mian 1996 Smith&Stulz 1985 Stulz 1996 Warner 1977
Coordination between Financing and Investment Policy (Acces to external financing)	Bessembinder 1991 Froot&Scharstein 1993 Leland 1998 Mayers&Smith 1987 Mello 1995 Smith&Stulz 1985 Stulz 1996
Ameliorate Conflicts of Interest between Shareholders and Bondholders	Mayers&Smith 1987 Mian 1996 Myers 1977

- **Empirical Literature Review - Hedging Level - First Part:**

Variables Employed	Hyp	Results	Author(s) of Study
LT Debt / MarketValue	+	Yes	Dionne&Garand 2003, Gay&Nam 1998, Graham&Rogers 2000
			Haushalter 2000(oil), Howton&Perfect 1998, Tufano 1996(gold)
		No	Allayanis 2001, Howton&Perfect 1998
Interest Cover	-	Yes	
		No	Gay&Nam 1998, Howton&Perfect 1998
Credit Rating	-	Yes	Haushalter 2000 (oil)
		No	Graham&Rogers 2000
Return on Assets		Yes	Graham&Rogers 2000 (weak)
		No	Allayanis 2001
R&D	+	Yes	Allayanis 2001, Gay&Nam 1998, Graham&Rogers 2000
			Howton&Perfect 1998
		No	
MarketValue/BookValue	+	Yes	Gay&Nam 1998
		No	Allayanis 2001, Graham&Rogers 2000
DivYield (1) or Payout (2)	+	Yes	Berkman&Bradbury 1996 (NZ) (2), Dionne&Garand 2003 (1)
		No	Allayanis 2001 (dummy), Graham&Rogers 2000 (1)
			Haushalter 2000 (oil) (2)
Capital Expenditure	+	Yes	Haushalter 2000 (oil, weak)
		No	Graham&Rogers 2000, Tufano 1996 (gold)
Price Earnings Ratio	+	Yes	Gay&Nam 1998
		No	Berkman&Bradbury 1996 (NZ)

- **Empirical Literature Review - Hedging Level - Second Part:**

Variables Employed	Hyp	Results	Author(s) of Study
Cash Flows	-	Yes	Howton&Perfect 1998
		No	
Managerial Share	+	Yes	Graham&Rogers 2000, Tufano 1996 (gold)
		No	Berkman&Bradbury 1996 (NZ), Gay&Nam 1998, Haushalter 2000 (oil)
Managerial Option	-	Yes	Haushalter 2000 (yes&no) (oil), Tufano 1996 (gold)
		No	Gay&Nam 1998, Graham&Rogers 2000
Convertible Debt	+/-	Yes	
		No	Berkman&Bradbury 1996 (NZ), Gay&Nam 1998, Howton&Perfect 1998
Preference Capital	+/-	Yes	
		No	Berkman&Bradbury 1996 (NZ), Gay&Nam 1998, Howton&Perfect 1998
Liquidity	-	Yes	Howton&Perfect 1998, Tufano 1996 (oil)
		No	Allayanis 2001, Berkman&Bradbury 1996 (NZ), Haushalter 2000 (oil)
Diversification	-	Yes	
		No	Haushalter 2000 (oil), Tufano 1997 (gold)
Size	+	Yes	Allayanis 2001, Berkman&Bradbury 1996 (NZ), Dionne&Garand 2003 Graham&Rogers 2000, Haushalter 2000 (oil)
		No	Gay&Nam 1998, Tufano 1996 (gold)
NOL carryforward	+	Yes	Berkman&Bradbury 1996 (NZ), Dionne&Garand 2003
		No	Allayanis 2001, Gay&Nam 1998, Howton&Perfect 1998, Tufano 1996(gold)
Foreign Sales	+	Yes	Allayanis 2001, Graham&Rogers 2000 (weak)
		No	

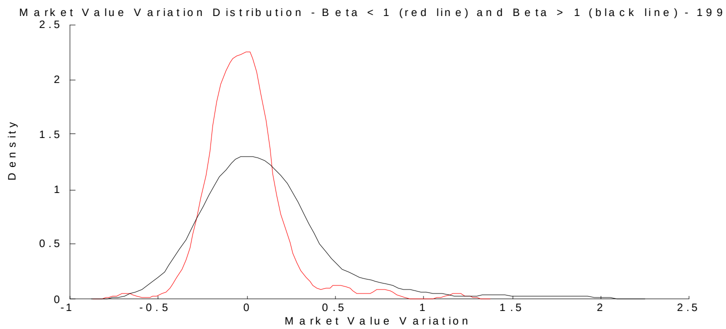
- **Empirical Literature Review - Hedging Decision - First Part:**

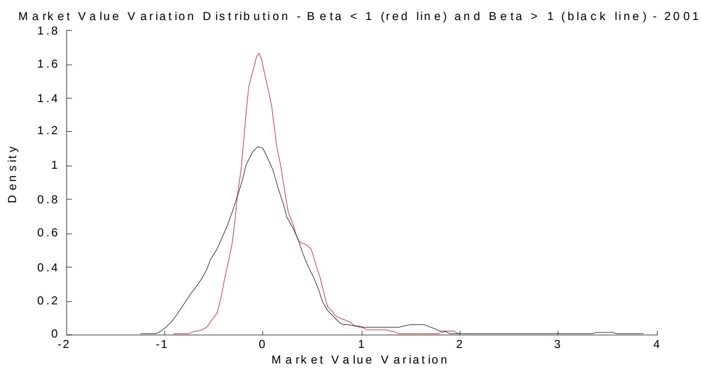
Variables Employed	Hyp	Results	Author(s) of Study
LT Debt / MarketValue	+	Yes	Clark&Judge 2005 (UK), Dolde 1995, Foo&Yu 2005
		No	Allayanis 2001, Fok&Caroll 1997, Francis&Stephan 1993
			Géczy&Minton 1997, Nance&Smith 1993, Wysocki 1996
Interest Cover	-	Yes	Fok&Caroll 1997
		No	Francis&Stephan 1993, Nance&Smith 1993, Wisocki 1996
Credit Rating	-	Yes	Clark&Judge 2005 (UK), Foo&Yu 2005
		No	Géczy&Minton 1997
R&D	+	Yes	Allayanis 2001, Dolde 1995, Fok&Caroll 1997, Foo&Yu 2005
			Géczy&Minton 1997, Nance&Smith 1993 (weak)
		No	Clark&Judge 2005 (UK)
MarketValue/BookValue	+	Yes	Nance&Smith 1993, Wysocki 1996
		No	Allayanis 2001, Clark&Judge 2005 (UK), Fok&Caroll 1997
			Géczy&Minton 1997, Mian 1996
DivYield(1) or Payout(2)	+	Yes	Foo&Yu 2005 (1), Nance&Smith 1993 (2)
		No	Allayanis 2001(dummy), Fok&Caroll 1997(1), Wysocki 1996(1)
Managerial Share	+	Yes	Wysocki 1996
		No	Fok&Caroll 1997, Géczy&Minton 1997
Managerial Option	-	Yes	Foo&Yu 2005, Wysocki 1996
		No	Géczy&Minton 1997

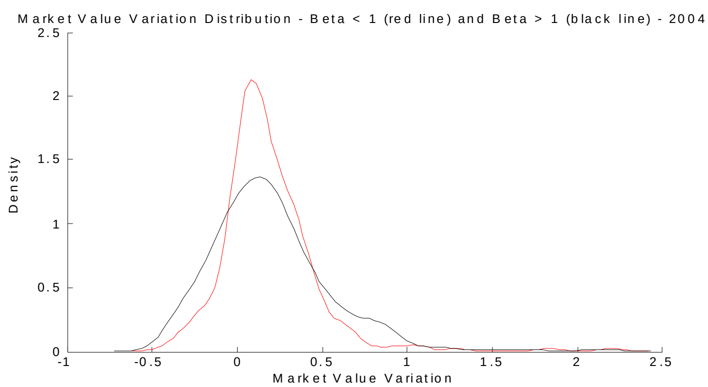
- **Empirical Literature Review - Hedging Decision - Second Part:**

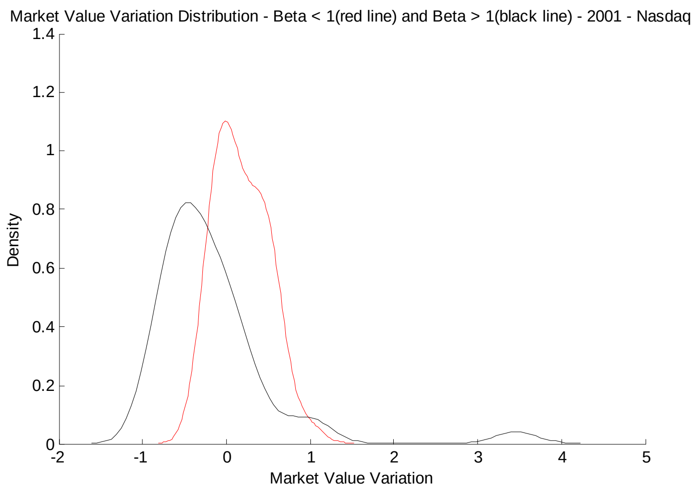
Variables Employed	Hyp	Results	Author(s) of Study
Convertible Debt	+/-	Yes	Fok&Caroll 1997 (weak)
		No	Nance&Smith 1993, Wysocki 1996
Preference Capital	+/-	Yes	
		No	Fok&Caroll 1997, Nance&Smith 1993, Wysocki 1996
Quick Ratio	-	Yes	Clark&Judge 2005 (UK), Fok&Caroll 1997(weak), Foo&Yu 2005 Géczy&Minton 1997
		No	Allayanis 2001, Nance&Smith 1993
Diversification	-	Yes	
		No	Fok&Caroll 1997
Size	+	Yes	Allayanis 2001, Fok&Caroll 1997, Foo&Yu 2005, Géczy&Minton 1997 Mian 1996, Nance&Smith 1993, Wysocki 1996
		No	
Total Sales	+	Yes	Fok&Caroll 1997, Francis&Stephan 1993
		No	Dolde 1995
NOL carryforward	+	Yes	Clark&Judge 2005 (UK), Foo&Yu 2005
		No	Allayanis 2001, Dolde 1995, Fok&Caroll 1997, Géczy&Minton 1997 Mian 1996, Nance&Smith 1993, Wysocki 1996
Foreign Sales	+	Yes	Clark&Judge 2005 (UK), Wysocki 1996
		No	

- **Distribution estimations for CF and SCOR variations by the kernel-gaussian estimation method:**

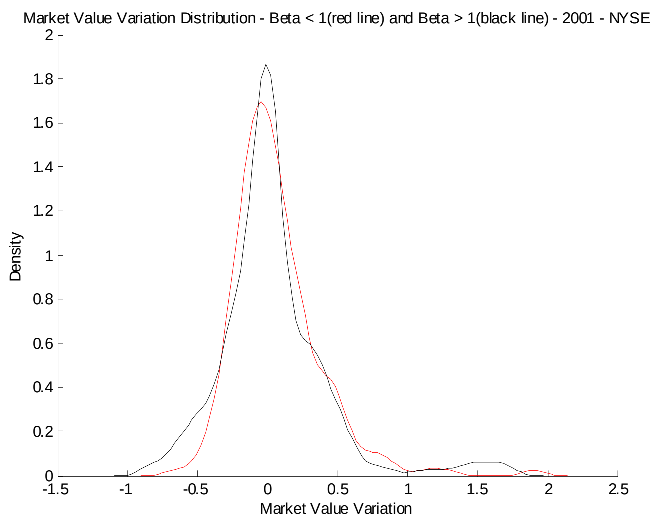




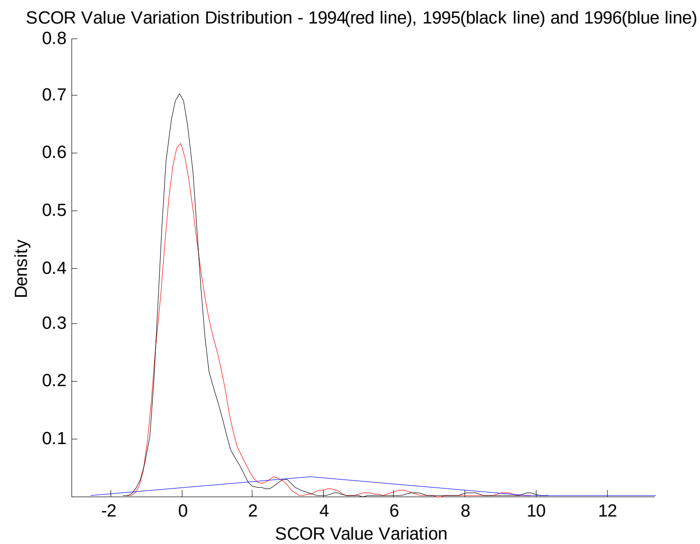


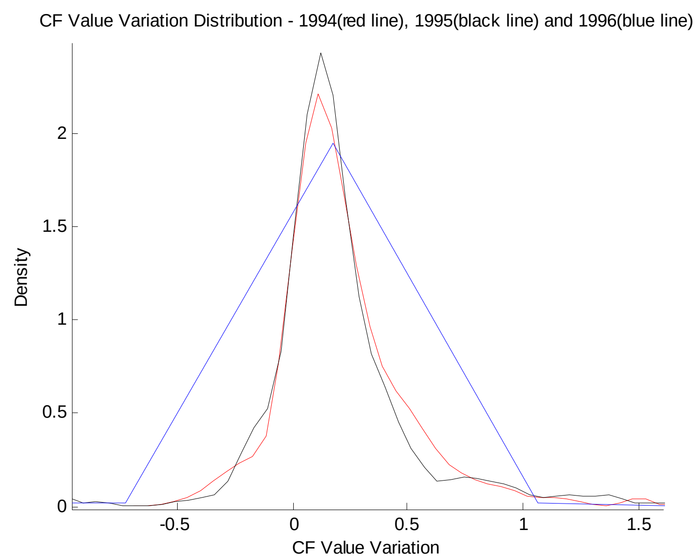


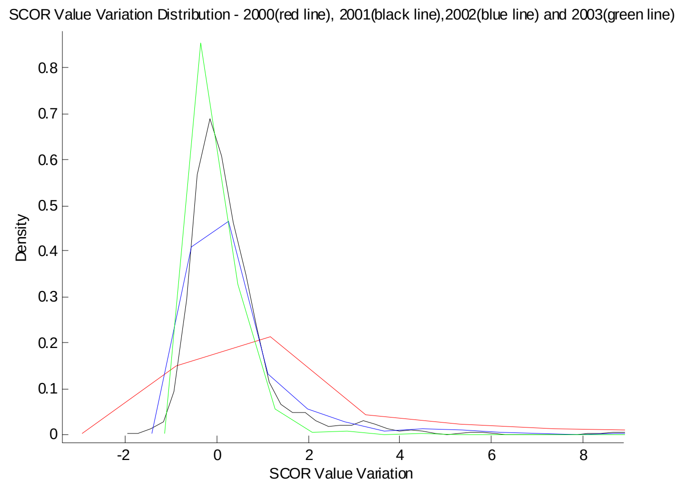
Market Value Variation Distribution - Beta < 1(red line) and Beta > 1(black line) - 2001 - Nasdaq
Density
Market Value Variation
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-2
-1
0
1
2
3
4
5

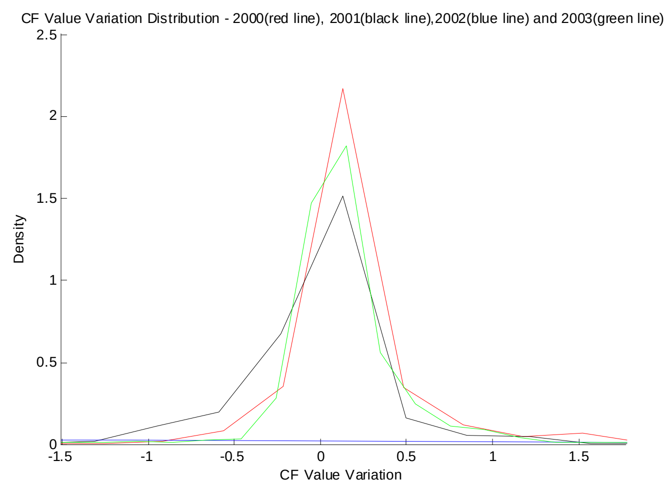


Market Value Variation Distribution - Beta < 1(red line) and Beta > 1(black line) - 2001 - NYSE
Density
Market Value Variation
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5


SCOR Value Variation Distribution - 1994(red line), 1995(black line) and 1996(blue line)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Density
-2
0
2
4
6
8
10
12
SCOR Value Variation


CF Value Variation Distribution - 1994(red line), 1995(black line) and 1996(blue line)
2
1.5
1
0.5
0
Density
-0.5
0
0.5
1
1.5
CF Value Variation


SCOR Value Variation Distribution - 2000(red line), 2001(black line),2002(blue line) and 2003(green line)
Density
SCOR Value Variation


CF Value Variation Distribution - 2000(red line), 2001(black line),2002(blue line) and 2003(green line)
Density
CF Value Variation

- **Correlation Table of the variables used in 3.4:**

	Flex	Lg(Ass)	DivYi	MV/BV	LT D/MV	R&D	Quick	ForeignS	NOL	Lg(MgStk)
Flexibility	1.00									
Log (Assets)	0.12	1.00								
Dividend Yield	0.06	0.55	1.00							
MValue/BValue	0.03	-0.11	-0.01	1.00						
LT Debt/MValue	0.01	-0.02	-0.01	0.83	1.00					
R&D/Assets	-0.16	-0.21	0.03	-0.05	-0.09	1.00				
Quick Ratio	-0.19	-0.26	-0.04	-0.03	-0.07	0.46	1.00			
ForeignSales/Sales	-0.07	0.01	0.07	-0.06	0.00	0.44	0.27	1.00		
NOL/Assets	-0.01	-0.16	-0.07	-0.02	-0.02	0.25	-0.02	0.23	1.00	
Log(Managerial Stock)	-0.03	0.23	0.15	0.01	-0.08	-0.02	0.04	-0.02	-0.12	1.00
Log (Managerial Option)	0.00	0.05	-0.01	0.03	-0.03	0.06	0.16	0.06	-0.07	0.20